

093803

UNCLASSIFIED



LM093803

U.S. GENERAL ACCOUNTING OFFICE

STAFF STUDY

AIRBORNE WARNING AND CONTROL SYSTEM

DEPARTMENT OF THE AIR FORCE

FEBRUARY 1973

093803

~~713080~~

UNCLASSIFIED

CONTENTS

		<u>PAGE</u>
SUMMARY		1
CHAPTER		
1	INTRODUCTION	8
	History of AWACS	8
	Scope	9
2	WEAPON SYSTEM STATUS	10
	System Cost Experience	10
	Additional system costs	11
	Changes subsequent to issuance of SAR	12
	Contract data	12
	Long lead development funds	14
	Engineering change proposals (ECPs)	15
	Inflationary cost growth	15
	System Schedule Experience	15
	Changes subsequent to issuance of SAR	15
	System Performance Experience	16
	Changes subsequent to issuance of SAR	16
	Risk Resolution	16
3	TEST AND EVALUATION	18
	Planning	18
	Execution of Test Plan	21
	Evaluation and Reporting	23
	Use of Test Results for Decisionmaking Purposes	24
APPENDIX		
I	Picture of AWACS	25
II	The Clutter Problem	26
III	Allowance for price escalation in program	27
IV	Average fighter detection in clutter	28

ABBREVIATIONS

ADC	Aerospace Defense Command
AFFTC	Air Force Flight Test Center
AFSC	Air Force Systems Command
AWACS	Airborne Warning and Control System
DDR&E	Director of Defense, Research and Engineering
DOD	Department of Defense
DSARC	Defense System Acquisition Review Council
DT&E	Development Test and Evaluation
ESD	Electronic Systems Division
OSD	Office of Secretary of Defense
OT&E	Operational Test and Evaluation
OTH-B	Over-the-Horizon- Backscatter Radar Program
RDT&E	Research, Development, Test, and Evaluation
SAR	Selected Acquisition Report
SID	System Integration Demonstration
TAC	Tactical Air Command

SUMMARY

AIRBORNE WARNING AND CONTROL SYSTEM (AWACS)

SYSTEM DESCRIPTION AND STATUS

The Air Force is developing the AWACS to provide an overall airborne air surveillance capability with command, control and communication functions for air defense and tactical forces. Additionally, AWACS provides a peacetime capability for emergency air traffic control and area surveillance. AWACS will be able to detect and track aircraft at high and low altitudes over land and water and will permit the phasing down of existing Aerospace Defense Command (ADC) control and surveillance systems and phasing out of tactical Air Command (TAC) Airborne Command and Control Center aircraft (the C-130E). Appendix I is a picture of AWACS.

Although AWACS completed the validation phase in July 1970, the system did not advance directly into full-scale development. Rather, a radar demonstration using competitive designs, was conducted to insure the resolution of the prime technological risk--i.e., whether an airborne radar could detect and track airborne targets in spite of extraneous signal returns from the ground (clutter). Appendix II graphically depicts the clutter problem. This radar demonstration, called Brassboard, was successfully completed on October 5, 1972, when The Boeing Company--the AWACS prime contractor--announced selection of the Westinghouse Electric Corporation as the AWACS radar subcontractor.

On November 7, 1972, Boeing successfully completed the Airborne Tracking Demonstration, 4 months ahead of schedule. On December 21, 1972,

the results of these two demonstrations were presented to the Defense System Acquisition Review Council (DSARC). The DSARC met again on January 16, 1973. Approval for full-scale development was given on January 19, 1973, by the Deputy Secretary of Defense. System Program Office (SPO) personnel told us in December 1972 that the program presented by the Air Force had four instead of five Development Test and Evaluation (DT&E) aircraft and had a program cost of \$2,575.2 million, a reduction of \$86.1 million. Subsequently, in January 1973, the approved program was based on a 4 engine rather than an 8 engine configuration; had a program cost of \$2,467 million, for a total reduction of \$194 million; and had three DT&E aircraft.

COMING EVENTS

In April 1973, the Air Force plans to conduct a preliminary evaluation of interoperability and survivability aspects of AWACS in Europe.

Air Force Studies and Analysis is required to analyze whether changes in the AWACS program are appropriate in light of the current status of the modernized air defense program, and to submit a report by July 20, 1973.

The DSARC plans to meet again in September 1973 to determine whether the program should be continued, modified or terminated in the light of current requirements and alternatives.

In November 1973, the contract option for production long lead items is scheduled to be exercised.

COST

The September 1972 Selected Acquisition Report (SAR) program cost estimate of \$2,661.3 million for 42 AWACS was unchanged from the June 1971 SAR. The additional systems costs decreased by \$57.3 million to \$8.3 million due primarily to recent Office of the Secretary of Defense (OSD) guidance that directs only modification and component

improvement costs be included as additional systems costs. As a result, costs for replenishment spares, for example, were excluded on the September 1972 SAR. The program unit costs, ~~with those additional system costs that were included,~~ decreased by \$1.3 million to \$63.6 million.

The September 1972 SAR estimates for RDT&E and Procurement do not reflect Congressional actions to deny FY 73-74 Procurement funds for test aircraft with an offsetting increase in the incremental RDT&E account.

As of January 19, 1973, the approved program cost estimate was reduced to \$2,467 million. The Air Force is to make more cost reductions in the program, a cost goal of \$2,284 million having been established.

Price Escalation

As of September 1972, \$557.1 million was included in the cost estimate for inflation. This was unchanged from the June 1971 estimate. (See Appendix III).

Program Funding

The following table shows the funding status of the program as of January 31, 1973. No Procurement funds had been appropriated, only RDT&E.

(In Millions)

<u>Year</u>	<u>Appropriated</u>	<u>Reprogrammed</u>	<u>Current Program</u>	<u>Obligated</u>	<u>Expended</u>
1973	\$ 233.0	\$ (38.8) ^{1/}	\$ 194.2	\$ 24.2	\$ 1.9
1972	145.1	(5.8)	139.3	139.3	107.2
1971	87.0	-0-	87.0	87.0	87.0
1970+					
Prior	130.0	(38.1)	91.9	91.9	91.8
Total	<u>\$ 595.1</u>	<u>\$ (82.7)</u>	<u>\$ 512.4</u>	<u>\$ 342.4</u>	<u>\$ 287.9</u>

^{1/}\$15 million of this amount represents a general reduction in the RDT&E appropriation directed by Congress.

CONTRACT DATA

The AWACS acquisition contract was awarded to Boeing in July 1970. Part 1A, radar development, was essentially completed November 1972, when the subcontract for the radar was awarded to Westinghouse Electric Corporation. Part 1B, full-scale development, was approved January 1973. However, Boeing had been authorized to make or buy long lead items for part 1B in January 1972.

Parts 1A and 1B are on a cost-plus-incentive fee basis. Part 1C, production, is on a fixed-price-incentive, successive-target basis.

Through November 1972, 87 contract modifications have been processed and the revised contract obligations and funding limitation at that date was \$253.3 million. Of this, about \$59 million was initially for long lead items preparatory to the full-scale development phase. This was increased by about \$20 million for program enhancement -- i.e., reconfiguration of the losing brassboard aircraft into the first of the development aircraft and installation of additional equipments (communications, displays, navigation, etc.) onto the system integration demonstration aircraft, to provide more meaningful operational test data on a full-up system prior to a production decision.

The SPO has approved 18 engineering change proposals and had five more under evaluation, all without cost impact. The SPO had also approved six value engineering change proposals and had one under evaluation. Estimated cost savings were \$9.755 million.

The DOD Cost/Schedule Control Systems Criteria, DOD Instruction 7000.2, has been implemented on the Boeing contract. Data provided by Boeing is used in the day-to-day evaluation of cost and schedule performance and the visibility therefrom has been a definite contributor to the under-cost, ahead-of-schedule condition of the AWACS program.

PERFORMANCE

The Air Force estimated that all planned operational characteristics would be achieved. The reported performance values on the September 1972 SAR remained unchanged except for an estimated 46% improvement in the fighter detection range established for Brassboard by the Development Concept Paper.

The January 1973 approval impacted one operational characteristic. SPO personnel stated that the change to a 4 engine configuration, using the TF-33 P-7 engine now used in the C-141 aircraft, would reduce the time on station by at least 2 hours. They added that other operational characteristics will not be affected.

PROGRAM MILESTONES

The significant schedule dates in the September 1972 SAR remained unchanged except for the "Rollout Of The First DDT&E Aircraft" milestone which improved by 4 months -- from May 1975 to January 1975. This improvement resulted from use and reconfiguration of one of the two Brassboard aircraft -- the Hughes radar equipped aircraft -- instead of waiting to develop and equip a third aircraft.

SPO personnel stated that the January 1973 approval will not have any impact on program milestones.

RELATIONSHIP TO OTHER PROGRAMS

AWACS is being developed to modernize our present air defense and tactical defense systems. In regards to its CONUS air defense mission, AWACS is one of several systems being developed by the Air Force. Other related systems are the Over-The-Horizon-Backscatter (OTH-B) radar and a new interceptor fighter, possibly a modification of the F-15.

At a meeting of the OTH-B DSARC principals on November 21, 1972, issues were raised about the OTH-B and the air defense mission which could impact on AWACS. To preclude classifying this report, these issues are not discussed here. (See our staff study on the OTH-B).

SELECTED ACQUISITION REPORTING

The AWACS is reported on this system in accordance with DOD instructions.

TEST AND EVALUATION

Testing is one of management's key controls in the acquisition process. It gives visibility to problem areas and enables management to make informed judgments on the progress of weapon system development.

In our opinion, the AWACS Brassboard Radar and Airborne Tracking test programs were well-structured. Also, test results were properly assessed and made available to decisionmakers.

MATTERS FOR CONSIDERATION

The Congress may wish to consider the following:

- the change to the AWACS engine and the corresponding reduction in time on station

- the results of the European evaluation
- the Air Force Studies and Analysis evaluation of the
status of the air defense program
- the relationship with the system's complementary system,
OTH-B in the ADC mission. In this regard, note the issues
raised in our staff study of the OTH-B system.

AGENCY REVIEW

A draft of this staff study was reviewed informally by selected Air Force officials associated with the management of the program, and their comments were incorporated in the report as we believe appropriate. We know of no residual difference with respect to the factual material presented herein.

CHAPTER 1

INTRODUCTION

The March 1972 AWACS staff study reported on the history and management of the program through June 1971, while it was in the advanced development phase of the acquisition cycle. This staff study covers the management of the program to the completion of this phase and the DSARC meetings in December 1972 and January 1973.

HISTORY OF AWACS

Since June 1971 the program continued in the advanced development phase. Two candidate radar systems were developed by Hughes Aircraft Company and Westinghouse Electric Corporation, ground tested and delivered to the prime contractor (Boeing) by January 1972. In February 1972 the rotodome equipped Boeing 707/320 aircraft completed the airworthiness test flights. The two competing radars were then installed in aircrafts and flight tests of the radar subsystems were begun in March 1972. The initial period, called optimization, was to be completed by May 15, 1972, but was extended to allow the subcontractors to make changes to their radar equipment. Because of this, the flight test completion date was extended from July 23, 1972, to August 31, 1972. Boeing prepared the summary test report in September 1972 and selected Westinghouse as the radar subcontractor for the full-scale development phase.

The Airborne Tracking Demonstration, originally scheduled for completion in March 1973 was completed in November 1972, 4 months ahead of schedule. The Westinghouse radar was used in the demonstration.

On December 21, 1972, the Air Force presented the results of the advanced development phase to the DSARC. Program approval to enter full-scale development was given January 19, 1973. The requirements for ADC and TAC were to be reassessed before the next DSARC in September 1973.

SCOPE

The staff study was prepared by the AWACS System Program Office (SPO), Electronic Systems Division, Air Force Systems Command and was test checked by the General Accounting Office (GAO). The staff study was subsequently edited and updated prior to its submission to Congress.

CHAPTER 2

WEAPON SYSTEM STATUS

We reviewed the September 1972 Selected Acquisition Report (SAR) for continuing data on cost, schedule and performance of the AWACS program. The review placed emphasis on the analysis of variances that have occurred since the June 1971 SAR. Major changes reflected in the SAR were:

- A 4 month schedule improvement in rollout of the first eight engine DT&E aircraft
- A 46% increase in fighter detection range called for by the current Development Concept Paper.

SYSTEM COST EXPERIENCE

As of September 30, 1972, the current program cost estimate for 42 AWACS was unchanged from the June 1971 SAR. The estimates were:

(\$ In Millions)

	Planning Estimate <u>11/68</u>	Current Estimate <u>6/71</u>	Current Estimate <u>9/72</u>
RDT&E	\$ 692.7	\$ 880.2	\$ 880.2
Procurement	<u>1,964.0</u>	<u>1,781.1</u>	<u>1,781.1</u>
Program Cost	<u>\$ 2,656.7</u>	<u>\$2,661.3</u>	<u>\$2,661.3</u>
Quantity	64	42	42
Program unit cost	\$ 41.4	\$ 63.4	\$ 63.4

The September 1972 SAR did not reflect the Congressional action on the AWACS fiscal year 1973 appropriation in which the Air Force was required to buy three development aircraft incrementally with RDT&E funds rather than full funding with procurement monies.

Additional System Costs

The additional system costs of \$65.6 million in the June 1971 SAR decreased \$57.3 million to \$8.3 million in the September 1972 SAR. The Air Force deleted five of six additional system cost categories and increased the other, as follows:

<u>Additional System Costs Categories</u>	<u>(\$ in millions)</u>	
	<u>June 1971</u>	<u>September 1972</u>
<u>Increased</u>		
Modifications	\$ 5.0	\$ 8.3
<u>Deleted</u>		
Common AGE	19.3	
Common AGE spares	0.7	
Replenishment Spares	30.4	
Modification Spares	0.7	
Component Improvement	9.5	
	<u>\$65.6</u>	<u>\$ 8.3</u>

The category "Component Improvement" was deleted September 1972, with the notation that the costs were not applicable because the engines were to be contractor furnished equipment. The other four categories were deleted March 1972 because of OSD guidance which required only the reporting of modification and component improvement cost data as additional system costs.

Changes Subsequent to
Issuance of SAR

As of January 19, 1973, the approved program cost estimate was \$2,467 million, a reduction of \$194 million from the September 1972 SAR. About \$109 million of this reduction was due to a reassessment of risk/engineering change order factors based on Brassboard experience.

About \$85 million of this decrease resulted from changing the engine configuration from eight to four engines, supplying all engines and UHF radios as Government Furnished Equipment (GFE), and changing the engine to be used. Instead of using the TF-34 engine (also to be used by the Navy on the S-3A and by the Air Force on the A-10), the Air Force changed to the TF-33 P-7 engine now used on the C-141 and already in inventory. The reason for these changes was to cut down on development expenses. (Note that some problems had been experienced in developing the TF-34 engine. See our staff study on the S-3A aircraft for more information on the TF-34 engine.)

Contract Data

Boeing completed the Brassboard Radar Demonstration on August 30, 1972, and the Airborne Tracking Demonstration on November 7, 1972. In January 1972, the Air Force authorized Boeing to make or buy long lead equipment needed during full-scale development.

As of October 31, 1972, the Air Force issued 87 modifications to the Boeing contract. The revised obligations and funding limitations for the contract were:

Part 1A (Brassboard)	\$172,500,000
Part 1B (Long lead development)	79,002,793
Award Fees	<u>1,750,000</u>
	<u>\$253,252,793</u>

The AWACS staff study issued by GAO in March 1972 covered the first 27 modifications. Significant modifications since that report were:

Part 1A

Phased array wind tunnel test	\$ 41,230
Disallow Westinghouse pre-contract costs	(656,678)

Part 1B

Long lead development requirements	78,800,000
Evaluation study of AFSCS UHF transceiver for use on AWACS in lieu of UHF radios currently programmed	202,793

Award Fee

Boeing Company	900,000
Westinghouse Electric Corp.	425,000
Hughes Aircraft Company	425,000

On March 1, 1972, the Secretary of the Air Force authorized the AWACS "Enhanced Program" to improve the System Integration Demonstration (SID). This action was subsequently approved by OSD on August 14, 1972. Originally conceived as a single thread effort to demonstrate the integration of at least one of a kind of the various elements of the mission system, the SID was enhanced by adding more communications equipment, display consoles and an on-board maintenance capability. Considerable increased visibility of operational suitability will be provided prior to the production decision. Additionally, the enhanced

program also involved the use of the losing Brassboard aircraft. By modestly increasing the minor effort begun in February on the engine/nacelle configuration, this aircraft will be available for testing 8 months ahead of the previous schedule. This 8 month improvement resulted from the 4 month earlier rollout (a SAR milestone) and a 4 month reduction in check-out and ground tests subsequent to rollout but before first flight. This program was designed to improve the AWACS test program in order that operational commands may gain early visibility of system utility and to increase visibility of development progress through test prior to major decision points. This enhancement is funded through the rephasing of Brassboard risk money which was not required during the Brassboard Phase.

Long Lead Development Funds

The contract specified that, after acceptance of the radars from the subcontractor in December 1971, the Air Force would authorize Boeing to procure long lead development items under part 1B. It also imposed a funding limitation of \$58.1 million. Through October 31, 1972, the funding limitation has increased to \$78.8 million. This \$20.8 million increase in long lead funding is attributable to the program enhancement authorized by the Secretary of the Air Force. It does not represent an actual increase in target costs but involves a rephasing of funds that were to be used later in the program.

Engineering Change Proposals (ECPs)

The March 1972 staff study discussed two ECPs that could have increased system costs--one for crash and voice recorders and one for the transfer of wind tunnel testing to the Air Force Arnold Engineering Development Center. The two ECPs were subsequently disapproved.

As of October 31, 1972, the SPO approved 18 ECPs and had 5 more under evaluation. None of these had any cost impact on the system. The SPO had also approved 6 value engineering change proposals with an estimated cost savings of \$9.755 million, and had one on hand which was subsequently disapproved.

Inflationary Cost Growth

At September 30, 1972, the current estimate for inflationary cost growth within the system estimate remained at \$557.1 million (see appendix III).

SYSTEM SCHEDULE EXPERIENCE

The schedule section of the September 1972 SAR remained unchanged except for the "Rollout Of First DDT&E Aircraft", a milestone which was rescheduled from May 1975 to January 1975 (see Figure 1). The 4 month improvement was due to the use and reconfiguration of the losing brassboard aircraft under the "Enhanced Program."

Changes Subsequent to Issuance of SAR

Approval to enter full-scale development was given January 19, 1973, 2 months later than scheduled. SPO personnel stated, however, that this action will not affect any of the remaining schedule milestones.

Also, a new milestone date was added to the program--September 1973. At that time, a decision is to be made whether to continue, modify, or terminate AWACS in view of the then current requirements and alternatives. In this interim period, Air Force Studies and Analysis is to review air defense and tactical requirements.

SYSTEM PERFORMANCE EXPERIENCE

The September 1972 SAR showed one change in performance--i.e., there was a 46 percent improvement in "Fighter Detection Range." This is based on Brassboard test results (see Chapter 3-Testing).

Changes Subsequent to Issuance of SAR

The January 1973 approval changed the AWACS to a 4 engine (TF-33 P-7) configuration, rather than the 8 engines (TF-34) previously authorized. The TF-34 engine was selected because it increased the time on station. The TF-33 engine will decrease the time on station by 2 hours from the SAR specification of 7 hours. SPO personnel stated that the other technical performance characteristics will not change.

RISK RESOLUTION

The Air Force, prior to contract go-ahead in 1970, had identified nine program risks, as follows:

1. Design and fabrication of Brassboard radars.
2. Timely assurance of Brassboard flight vehicle airworthiness.
3. Development of the TF-34 engine.

4. Ability of Brassboard radars to demonstrate satisfactory radar performance.
5. Integration of tracking function.
6. Software Development.
7. Integration of surveillance and control functions.
8. Air vehicle operating performance limits.
9. Reliability of radar subsystem.

The first five were resolved by the end of the Airborne Tracking Demonstration in November 1972. The remaining four are scheduled to be resolved during full-scale development. The Brassboard program did not identify any new risk items.

BEST DOCUMENT AVAILABLE

CHAPTER 3

TEST AND EVALUATION

Testing new weapons is one of the Department of Defense's (DOD) key controls in the complex process of acquiring multibillion dollar systems. The successful completion of a test program involves not only the conduct and evaluation of the tests, but also the planning, recording and reporting efforts which precede and follow it. The real benefit of testing is in properly assessing the risk and in delivering test results to the decisionmaker at key decision points in the acquisition cycle. We believe that the Brassboard Radar and Airborne Tracking Demonstration test programs were well-structured and that test results were properly assessed and made available to the decisionmakers.

PLANNING

Of the nine technical risks identified and mentioned in Chapter 2, the most significant was the ability of the radar to detect targets of interest against a background of ground clutter. Complying with the DOD concept of "fly-before-you-buy", in 1970, the Air Force structured the AWACS program to resolve/minimize risks associated with the radar. The program incorporated the following demonstrations:

Brassboard Radar Demonstration - First, flight tests were to be conducted to evaluate how well two radar candidates met detection and tracking requirements.

Airborne Tracking Demonstration - As part of Brassboard, an Airborne Tracking Demonstration was to be conducted with the winning radar and a computer placed on the aircraft to demonstrate that the specified tracking capability could be achieved in an airborne environment.

System Integration Demonstration - One of each subsystems was to be installed in the aircraft. Flight tests were to be conducted to resolve system integration problems, assess electronic countermeasures, and determine how well other critical performance requirements were being met.

In March 1972, the Secretary of the Air Force approved the AWACS enhanced program to increase the test visibility of the System Integration Demonstration by installing additional equipment on the aircraft.

The Brassboard Demonstration required two aircraft with rotodomes installed. The other two demonstrations--airborne tracking and system integration--were to be performed in the winning brassboard aircraft.

Detailed test procedures were prepared by the contractor and approved by the SPO prior to conduct of test. Once approved, revision of the test plans/procedures could be made only with the mutual concurrence of both the SPO and the contractor.

Since major program decisions are based upon test results, a test division was established at the contractor's plant. This division provided the SPO with full visibility of the contractor's test effort and the rapid response required to avoid program delay.

A Brassboard Support Planning Working Group was established by SPO to coordinate flight test plans, operations plans for target aircraft and Semi-Automatic Ground Environment (SAGE) and SAGE/contractor data processing interfaces. The group's membership included representation from the contractor, SPO, and user as well as Air Force development commands.

The Brassboard Operations Plan was prepared in accordance with applicable portions of Air Force Directives. This plan includes the concept of operations; task force organization and responsibility; flight operations information; letters and memoranda of agreement; and communications, SAGE data and search/rescue requirements.

An Initial Operational Suitability Test Working Group was established by the SPO to develop plans for Operating/Supporting Command participation in all AWACS test programs. The group functions in an advisory capacity, providing a channel for the development of criteria for the assessment of operational suitability of AWACS. It defines the participation of the Operating/Supporting Commands in the System Integration Demonstration test planning, test conduct, and data reduction required to enable them to accomplish an independent evaluation and report on operational suitability prior to the production go-ahead. This group will assure that, where possible, maximum Operational Test and Evaluation (OT&E) objectives are met in conjunction with Development Test and Evaluation (DT&E).

The Air Force Flight Test Center (AFFTC), Edwards AFB, California, has been designated by Hq Air Force Systems Command (AFSC) as the Responsible Test Organization (RTO). AFFTC supported the SPO's Contract Definition Phase efforts, participated in the conduct of the Brassboard flight test program, and is currently supporting System Integration Demonstration and DT&E test planning efforts. This

participation will (1) provide AFFTC the background and training necessary to permit assumption of responsibility for planning and conduct of later phases of DT&E and (2) provide visibility to avoid unnecessary duplication of contractor/Air Force testing.

Headquarters USAF is implementing a new management tool in the form of a Test Objective Annex (TOA) to the Program Management Directive (PMD). The purpose of the TOA is to define the essential performance and the operational, logistical and training objectives which must be addressed in the systems test program. The TOA also provides the baseline criteria that the Implementing, Operating, and Supporting Commands will use to evaluate performance, utility and supportability of the weapon system. The AWACS SPO submitted the first TOA. This was accepted by AFSC and USAF without change and has been incorporated into the PMD. The TOA has been adopted as part of all future Air Force program documentation.

EXECUTION OF TEST PLAN

The Brassboard Demonstration, which started in March 1972, provided time for the radar subcontractors to check out their equipment while airborne. These optimization flights, scheduled to end about May 23, 1972, were extended to July 31, 1972 to allow the subcontractors to make various changes to their equipment. Because of this, the radar "fly-off", scheduled to end July 23, 1972, did not begin until

August 1, 1972. In this regard, the SPO has the option to vary testing within a phase if required. Thus, the Brassboard flight test program easily accommodated delays encountered in ~~radar~~ optimization. Within the same framework, as discussed later, the Airborne Tracking Demonstration was completed 4 months ahead of schedule.

The Brassboard flight test program was conducted over specified terrains at speeds and altitudes which were representative of the operational environment that the AWACS will encounter. Target aircraft were selected on the basis of their radar cross section and performance characteristics.

Performance data were collected on the radars throughout the month of August. Detection range data were collected using F-4 and F-106 aircraft and a constant cross section standard target generator. Data were also collected for use in a ground tracking facility to determine the ability of each radar to track airborne targets. Limited electronic countermeasures (ECM) testing was also performed on both radars with EA-6B, F-4 and B-57 aircraft. Flight tests were completed August 31, 1972.

The Airborne Tracking Demonstration, scheduled from December 1972 to March 1973, was actually completed by November 1972.

The System Integration Demonstration is in contract part 1B (full-scale development), which was approved January 19, 1973.

EVALUATION AND REPORTING

Although the completion of the Brassboard Tests Demonstration was delayed by over a month, the test report was prepared in September 1972 as scheduled.

Results of the Brassboard Demonstration indicated that both radars exceeded the DCP-5 performance goals, with Westinghouse having better performance than Hughes in most areas. Full-scale performance predictions indicated that either radar could meet the objectives; however, it was judged that Westinghouse presented less risk in achieving these projections. Appendix IV presents average fighter detection performance achieved by Westinghouse and Hughes during Brassboard.

The airborne tracking test report was issued December 4, 1972. The tests provided data which demonstrated the capability of the radar and the airborne tracking system to repeat the tracking performance demonstrated in the Brassboard flights--i.e., to track in a dense environment and to maintain 10 simultaneous tracks.

The AWACS milestone schedule required that the results of the Brassboard radar flights be available prior to the DSARC, originally scheduled for November 1972. If the data from these flights were inconclusive, the Air Force had an option to delay the DSARC until the results of the Airborne Tracking Demonstration were available. As can be seen above, both demonstrations were successful, and the results of both were available prior to the DSARC.

USE OF TEST RESULTS FOR
DECISIONMAKING PURPOSES

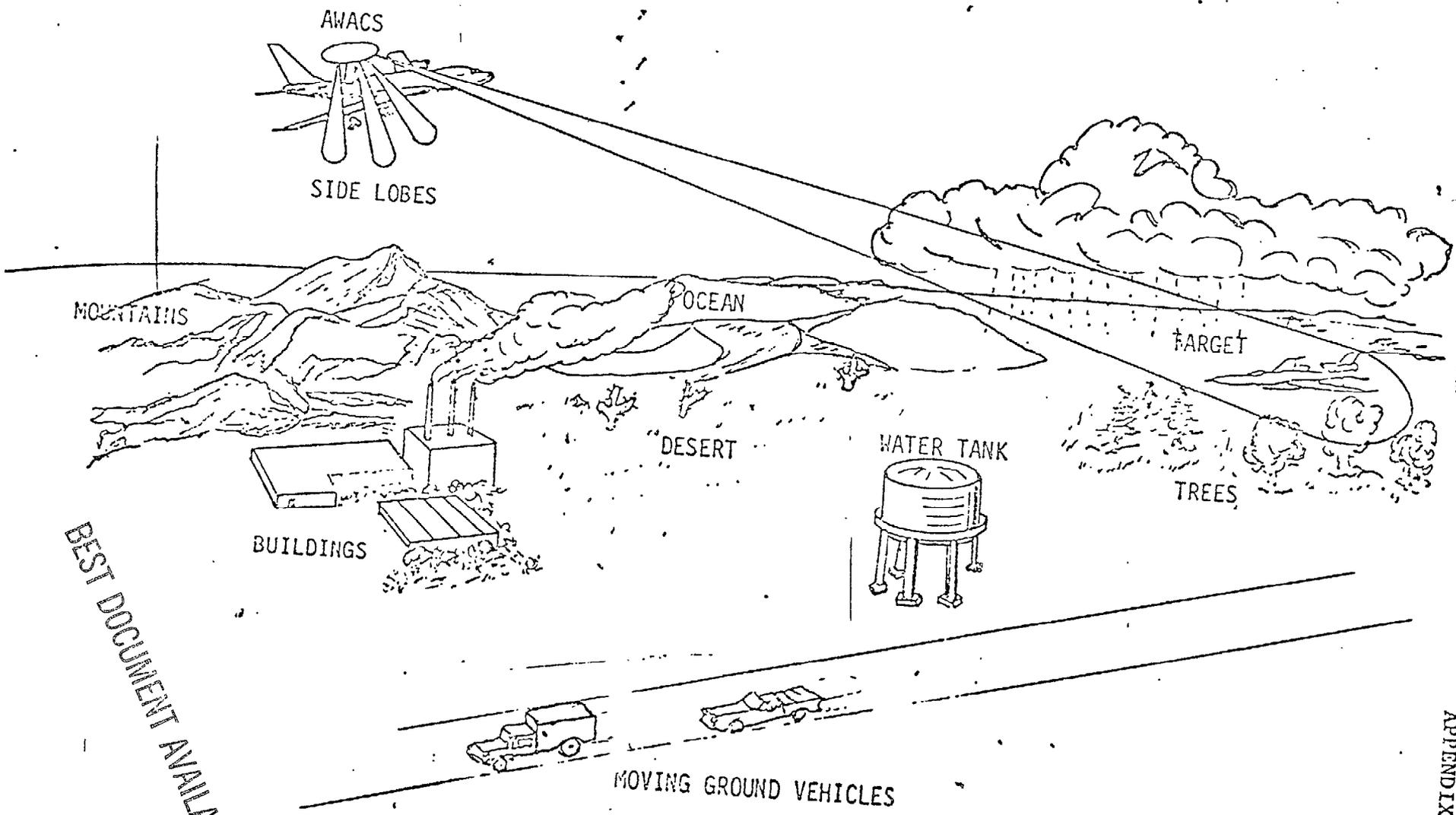
The DSARC met on December 21, 1972 and January 16, 1973. The Air Force briefing to the DSARC included the results obtained in the Brassboard and Airborne Tracking Demonstrations. At this writing, we do not know to what extent the DSARC relied on the test results.

BEST DOCUMENT AVAILABLE



BEST DOCUMENT AVAILABLE

THE CLUTTER PROBLEM



BEST DOCUMENT AVAILABLE

ALLOWANCE FOR PRICE ESCALATION
IN PROGRAM ACQUISITIONS COST ESTIMATES
(\$ In Millions)

<u>Cost Estimates</u>	<u>Planning Estimate 11/68</u>	<u>Development Estimate 6/70</u>	<u>Current Estimate 9/72 ^{1/}</u>
Total Estimates	\$2,656.7	\$2,661.6	\$2,661.3
Portion of estimate that is esca- lation	\$ None	\$ 556.1	\$ 557.1

^{1/}The current estimate in the September 1972 SAR was the same as that in the June 1971 and June 1972 SARs.

BEST DOCUMENT AVAILABLE

AVERAGE FIGHTER DETECTION IN CLUTTER

	<u>SEA</u>	<u>WOODLAND</u>	<u>FARM</u>	<u>MOUNTAINS</u>	<u>AVERAGE</u>
GOAL	100%	100%	100%	100%	100%
ACHIEVED BY:					
HUGHES	84%	88%	83%	95%	87%
WESTINGHOUSE	98%	97%	100%	106%	100%

NOTE: Percentages refer to contract specifications, which are greater than DCP 5 (Rev.2) requirements.

BEST DOCUMENT AVAILABLE